

declined significantly with time with decreases ranging from 60 percent to greater than 99 percent over a 13-year period.

- The expected reductive dechlorination daughter products of ethene-based VOCs are present in groundwater samples in the area downgradient of the Facility. Their presence is evidence that (1) conditions conducive to reductive dechlorination exist, and (2) organic substrate is present in sufficient volume to fuel microbial metabolism and enable cometabolism of the chlorinated ethenes by reductive dechlorination. The presence of petroleum hydrocarbons in groundwater may assist in the reductive dechlorination process by providing substrate for microbial activity.
- The highest concentrations of dissolved hydrocarbon gases and carbon dioxide correspond to areas where significant decreases in VOC concentrations have been observed. These dissolved gases are typically the end products of the complete dechlorination of chlorinated VOCs and therefore indicate that biodegradation processes go to completion at the Site.
- Sufficient concentrations of nitrate, iron, and sulfate are available for use as electron donor/acceptors, and it appears that they are being utilized by the microorganisms, thus creating an environment conducive to continued reductive dechlorination of chlorinated VOCs.
- Microbial degradation of VOCs (as evidenced by concentrations of indicator parameters and continuing declines in concentrations of VOCs) has not significantly decreased over the natural biodegradation monitoring period (3 years) and can be expected to continue at the Site.

4.5.9 Potential Offsite Source Evaluation

As noted in the discussions above, the chemical distribution data and the groundwater flow patterns indicate the presence of other offsite sources of chemicals to groundwater. A review of available public records was conducted to identify other potential offsite chemical sources at the Site. The review included the following:

- Acquiring a government-records search for sites listed on chemical and waste-related regulatory databases and located within approximately 1 mile of the Facility
- Acquiring a historical chain of title report on the properties at 1153, 1201, and 1207 Shafter Avenue (*NETR, 1999*)
- Reviewing and discussing public records with the San Francisco Department of Public Works (*SFDPW, 1924*) and the San Francisco Department of Public Health (DPH)

- Reviewing Site history information in the Consent Order (*DTSC, 1996*), the Phase I remedial investigation (*CH2M-Hill, 1987b*), the Phase 2 remedial investigation (*Dames and Moore, 1990*), and Holguin, Fahan, & Associates (*1990*)
- Evaluating aerial photographs of the Site taken in the years 1935, 1948, 1958, 1969, 1977, 1979, 1985, and 1988
- Reviewing documents on common industrial practices at metal finishing facilities (*U.S. EPA, 1998*) and putty manufacturing (*Ullmann's, 1991, Skeist, 1977, Cagle, 1973, First and Love, 1982, Kirk-Othmer, 1993, and American Chemical Society, 1999*)
- Reviewing documentation on and discussion with the DTSC on their visit to the Bay View Dry Cleaners on February 11, 1999.

The information collected and evaluated resulted in the identification of more than 50 sites that are potential sources of chemicals to soil and groundwater, not counting the Facility or non-point sources such as sewer lines and utility trenches. These sites are summarized on Table D1 and their locations shown on Plate D1 in Appendix D. The above-referenced title search and the DTSC dry cleaner visit notes have also been included in Appendix D.

To facilitate discussion, the following sections group the sites by industry or chemical use to summarize the chemicals typically used and possibly released to soil and /or groundwater. Some sites are listed in several groups due to multiple categories of chemicals that may be associated with a given site or due to historical changes in land use.

Potential Petroleum Hydrocarbon Sources

These sites are expected to have a high potential to use, store, or generate petroleum hydrocarbons such as gasoline, diesel, and motor, waste, and hydraulic oils. The automotive and trucking nature of some of these sites would also be expected to potentially result in the release of metals such as cadmium, chromium, lead, nickel and zinc (*RWQCB, 1990*) because these metals are often detected when releases from such sites have occurred. These kinds of sites might also use cleaning solvents for cleaning parts and equipment. The lists below present groups of specific potential offsite sources that might be petroleum hydrocarbon sources.

Auto salvage and wrecking:

- Sites 1, 2, 3, 12, 32, 52.

Auto and truck repair and auto body service:

- Sites 4, 5, 9, 13, 25, 26, 32, 44, 47.

Underground storage tanks (USTs):

- Site 8: 550-gallon gasoline UST
- Site 20: gasoline pump
- Site 21: 2000-gallon gasoline UST
- Site 24: 7500-gallon diesel removed 1988
- Site 28: 50-barrel fuel-oil UST
- Site 42: UST removed 1988
- Site 43: gasoline pump visible during building inspection
- Site 46: 1000-gallon; leaks to soil, gas and diesel.

Plate D1 shows that potential petroleum hydrocarbon sources are located throughout the Site, essentially surrounding the Facility and possibly providing multiple opportunities for the release of petroleum hydrocarbons to groundwater. In particular, the six auto salvage yards may constitute potential sources of petroleum hydrocarbons, as well as metals, fuel additives, and cleaning solvents found in groundwater at the Site.

Potential Chlorinated Solvent Sources

These groups of sites are expected to use, store, and dispose of chlorinated solvents, as well as other solvents and petroleum hydrocarbons. The lists and discussions below group the potential offsite sources by types of operations.

Dry Cleaning Operations:

In the typical dry cleaning process, the cleaning solvent, usually PCE, is recirculated until it is too soiled to be reused. Then it is disposed. Modern operations, considered to be those that use equipment manufactured within the last three years, may use distillation equipment to clean and recover more PCE than was formerly possible. In any event, process waste material, still containing some PCE, is then disposed. Older operations (those with equipment older than three years) have been known to dispose of waste material, sometimes containing significant quantities of PCE, down sewer lines. Because sewer lines are sometimes not water tight, groundwater at numerous sites throughout California has been contaminated with PCE (*RWQCB, 1992*). Two dry cleaning operations were identified in the vicinity:

- Site 49: Modern Drapery Service (documented PCE storage)
- Site 51: Bay View Laundry and Dry Cleaning Service (located across Hawes Street from the Facility).

On February 11, 1999, Bill Brown of the DTSC accompanied Jim Ambrose of the San Francisco Department of Environmental Health on an inspection of the Bay View Laundry and Dry Cleaning Service (Site 51). Mr. Bob Yuen, the site owner and operator was interviewed. The information acquired is as follows:

- Mr. Yuen stated that the operation began in 1980 to 1982.
- Records shown to Messrs. Ambrose and Brown indicated that the operation purchased 430.8 gallons of PCE in 1998.
- No areas of obvious spillage were observed.
- Mr. Yuen stated that the existing equipment was recently installed. Mr. Yuen was not asked about the specific date when the current equipment was installed.
- Mr. Yuen stated that waste PCE and filters are picked up by a disposal company six times per year, with each pickup generally consisting of between 8 and 18 gallons of waste PCE and 0 to 12 filters.

Although Mr. Yuen stated operations began sometime between 1980 and 1982, the 1985 aerial photograph shows the current building foundation to be in progress. This inconsistency regarding the

start of operations was not known at the time of inspection and, therefore, Mr. Yuen was not asked to clarify or explain the inconsistency of these dates.

Metal Works:

This group of sites includes operations that cut, form, plate, anodize, polish, finish, and otherwise work metal. The following lists identify the 13 sites in the metal works category:

Metal plating, polishing, finishing, sheet metal, machinery manufacturing:

- Sites 15, 18, 23, 30, 37, 38, 40, 48, 53.

Steel and iron works:

- Sites 10, 16, 19, 27.

Six of these sites immediately surround the Facility, with four of the sites immediately adjacent to the Facility and two of the sites across the street. According to a recent EPA report (*USEPA, 1995*), the list of metals, treatment chemicals, and cleaning solvents used by this industry is extensive and includes petroleum hydrocarbons, chlorinated and non-chlorinated solvents, metals, acids, and alkalis.

Appendix D presents a portion of a U.S. EPA research document including a list of chemicals potentially used in, generated by, or emitted from metal finishing operations (*U.S. EPA, 1985*). Numerous VOCs, including PCE, are on the list of chemicals used.

Other Manufacturing:

This category includes other manufacturing facilities that do not fit within the above categories:

Other manufacturing:

- Site 33: Wooden box manufacturing; two portable 50-gallon gas pumps
- Site 39: Putty manufacturing; probable lead, solvents, and oils
- Site 46: Arnold & Egan Manufacturing Company (records did not specify what was manufactured)

Food or animal processing:

- Site 21: Sausage

- Site 22: Meat processing
- Site 23: Beer storage
- Site 28: Tallow; animal hair cleaning and processing; curled hair factory; fuel oil tank.

All of the above-listed facilities likely used or use hydraulic and lubricating oils for equipment. The Site 33 operation might use or have used wood preservatives such as creosote, pentachlorophenol, copper, chrome, and/or arsenic.

Site 39 is of particular interest because this is the Vacant Lot at 1211/1217 Shafter Avenue, immediately adjacent to the Capped Yard. The specific chemicals used in the manufacture of putty vary widely and depend on the intended use and desired properties. No information was available on this specific operation. Some of the chemicals used in the putty manufacturing industry include oils, white lead (lead carbonate), and solvents.

The specific products manufactured at Site 46 were not identified in the records reviewed. All of the food processing operations are expected to use or have used refrigerants such as Freons.

Paints and Chemicals

The following sites include operations that use, store, and handle paints and chemicals. The list includes the expected types of chemicals that might be used.

- Site 7: Paints, lacquers, thinners, cleaning solvents, polyester resin, acetone, MEK
- Site 8, 10, 14, 20, 35, 36, 41, 44, 45: paints, lacquers, thinners, cleaning solvents.

Drum storage or reconditioning:

- Site 11: Anresco and Microtracers: Depends on the source of the drums and the residues, if any, in the drums
- Site 29: Former Bay Area Drum: Discussed in this report.

Chemical companies:

- Site 6: ether, unknown others.

The above-listed sites are scattered throughout the Site. Site 41, a carpenter and paint shop, is upgradient of the Facility. Site 14, a furniture refinishing shop, is downgradient of the Facility and is listed by the EPA as a hazardous waste generator. Furniture refinishers commonly use paint strippers which, historically have been based on caustics and on solvents such as benzene and MeCl.

5.0 CONCLUSIONS

This report completes the remedial investigation for the Site and presents a characterization of Site conditions supported by an evaluation of available historical and recent information regarding the Site. The information presented and evaluated describes the nature and extent of chemicals in soil and groundwater at the Site, and provides the information necessary to support the *Supplemental Risk Assessment* and the *Feasibility Study*. No further information is needed to proceed with the *Supplemental Risk Assessment* and the *Feasibility Study*, and to evaluate remedial alternatives for the Site. The conclusions developed in this remedial investigation are summarized below and are grouped into the following categories: (1) overall hydrogeologic conditions, (2) overall nature and extent of chemicals in soil and groundwater, and (3) closure of specific data gaps identified in the *Work Plan*.

5.1 Overall Hydrogeologic Conditions

The overall site hydrogeologic conditions are summarized as follows:

- The Site is underlain by four geologic units: artificial fill, Younger Bay Mud, Bay Side Sand, and the Franciscan Formation. Groundwater occurs predominantly in the Bay Side Sand unit, with significantly less flow volume through the other units. Groundwater monitored by Site wells occurs in one aquifer unit with the overall flow direction generally south towards the Yosemite Canal and the San Francisco Bay. On the basis of recent measurements during a tidal cycle, water-level differences were about 0.53 foot near Yosemite Canal (Well MW-5) and 0.02 feet at Well DMMW-7, 280 feet from the Canal. These data demonstrate the limited effect of tidal fluctuations in the vicinity surrounding the Site. Groundwater is the only significant transport mechanism for the potential migration of dissolved chemicals. Localized variations in groundwater flow occur in response to various causes as summarized below.
- The historical designation of shallow and deep monitoring wells is not supported by the lithologic and water-level data, even though the screened depth of wells varies significantly. With the exception of Monitoring Well DMMW-9, all water levels can be reasonably contoured together as one aquifer, including water levels from wells in the Vacant Lot, near the sewer box culvert, and other minor local variations. Only the water levels from Well DMMW-9 are inconsistent with those in surrounding wells and cannot reasonably be contoured with the water levels in surrounding wells. The vertical gradient between Monitoring Well DMMW-9 and the nearby Monitoring Well DMMW-10 is upward.